

Forecasting Indonesia's ginger export with major competing countries in the international market

Elpawati*, Puspi Eko Wiranthi, and Salma Nur Aisyah

Syarif Hidayatullah Islamic University Jakarta, Indonesia

*Corresponding author's e-mail: elpawati@uinjkt.ac.id

Received August 20th, 2022; revised September 17th, 2022; accepted September 24th, 2022

ABSTRACT

The volatile and unbalanced global demand for ginger makes it difficult for Indonesia to realize the decline and rise in exports. An analysis of export relations among between China, India, the Netherlands, and Indonesia is indispensable as these countries are the main exporters of ginger worldwide. Therefore, this ginger-exporting study aims to analyze the relationship between ginger exporting countries Indonesia, China, India, and the Netherlands from January 2013 to December 2017. Investigate the shock effect of increasing Chinese, Indian, and the Netherlands ginger exports on Indonesian ginger exports from January 2018 to December 2024. Explore the effect of changes in ginger exports in the four countries from 2018 to 2024. Analysis of relationships and influences over the next 6 years from 2018-2024 was performed using a time-series timeseries in the form of ginger export data from Indonesia, China, India, and the Netherlands for the 2013-2017. The analysis method used VAR (VECM), while the data were processed using Microsoft Excel 2010 and EViews 10 applications. The results showed a relationship between the four countries in the long term, significantly affecting the increase and decrease ginger exports in Indonesia, the Netherlands, and India. Between the 2018-2024, Indonesia's ginger exports will increase by 92%, followed by the Netherlands 7%, China 0.2%, and India 0.8%. For the China, ginger exports will increase 80% followed by Indonesia 4%, India 5%, and the Netherlands 11%. Meanwhile, for Indian ginger, an increase in exports will be dominated by India at 68%, Indonesia 20%, China 6%, and the Netherlands 6%. As for the Netherlands ginger exports, there will be an increase dominated by Indonesia at 73%, China 1%, India 5%, and the Netherlands 21%.

Keywords:

Export, Ginger, VAR, IRF, FEVD

1. Introduction

The potential for biopharmaceutical development in Indonesia is increasingly becoming wide open due to the availability of production land, and changes in people's views toward healthy and functional food patterns [1]. In addition, the increasingly widespread use of medicinal plants by other industries outside the traditional medicine and pharmaceutical industries, such as the food and beverage, as well as the cosmetics industry has increased their demand as raw materials [2]. Ginger is one of the leading products in the horticultural subsector is ginger. This plant that has many benefits as herbal medicine, raw material for the food and beverage industry, seasonings, fragrant oils, and cosmetics [3]. The demand for ginger, both domestic and foreign has continued to increase due to its peculiarities that cannot be replaced with another plan.

Indonesia's ginger production is in the ranks fifth position globally after India, China, Nigeria, and Nepal (average 1994–2021). In other words, Indonesia is the fifth-largest ginger-producing country in the world [4]. This has increased business opportunities in the form of herbs industry because the market share available is



quite wide in Indonesia and worldwide [5]. International ginger consumption, which has an increasing trend, has made the ginger market in producing countries grow and develop [6]. This increase also occurs in domestic ginger consumption. As domestic ginger production increases, the pace of Indonesian exports to various countries also rises. Meanwhile, exports reflect the production remaining production after fulfilling domestic needs. The world's demand for ginger has become volatile and unbalanced, thereby preventing the achievement of the targets that have been set [7,8]. A predictive instrument is needed to control the volume of production in the future and predict the amount of export demand over the next few years.

The role of forecasting to be implemented in the next few periods is expected to help Indonesia make the right decisions, by utilizing its resources efficiently and effectively. This in turn will create an opportunity to achieve Indonesian ginger export target in the future. Relations and influences between countries can sometimes lead to a decline or an increase in exports.

Based on the explanations above, the problems formulated for this study are as follows is there a co-integration relationship between ginger exporting countries namely Indonesia, China, India, and the Netherlands from January 2013 – December 2017? What are the results of forecasting ginger exports in Indonesia, China, India, and the Netherlands considering the magnitude of influence between exporting countries from January 2018 – December 2024? What are the managerial implications for Indonesia from the use of co-integration methods and the results of forecasting ginger exports between countries?

2. Methods

This research was conducted for 3 months, from September to December 2020. The research site in one of the household industries as well as other chili sauce entrepreneurs and production sites are in several villages/neighborhoods in Banggae District. The research sample was determined deliberately with the consideration of choosing the entire chili sauce business unit as many as 7 SMEs in Banggae District which processes chili sauce and has fresh chili mixture ingredients. The data used in this study with HS code 091010 (*Spices; Ginger*) were quantitative in the form of *time series* data for 60 months from January 2013 to December 2017. The data processing was conducted with *Microsoft Excel 2010* and *EViews 10* application programs. The VAR/VECM analysis method in the *EViews 10* application, started from the data stationary test on the export of each country. The VAR model is used when the data is stationary at a confidence level of 1%, 5%, and 10%, but when the data is stationary at *the first difference* (differentiator), the model used is VECM. The next stage involved the formation of the VAR model, as well as optimum lag and VAR stability test [9]. After the optimum lag was obtained and the VAR model became stable, the optimum lag was used for the next stage of analysis starting from the Johansen cointegration test when the selected model is VECM, Granger causality test, VAR/VECM model estimation, *Impulse Response Function* (IRF) and *Forecast Error Variance decomposition* (FEVD). The study uses the VAR/VECM analysis are the follows.

$$IDN_t = \varphi_1 + \delta_t t + \lambda_1 e_{t-1} + \gamma_{11} \Delta IDN_{t-1} + \dots + \gamma_{1p} \Delta IDN_{t-p} + \omega_{11} \Delta CHN_{t-1} + \dots + \omega_{2q} \Delta NLD_{t-q} + \varepsilon_{2t} \quad (1)$$

$$CHN_t = \varphi_2 + \delta_2 t + \lambda_2 e_{t-1} + \gamma_{21} \Delta CHN_{t-1} + \dots + \gamma_{2p} \Delta CHN_{t-p} + \omega_{21} \Delta IDN_{t-1} + \dots + \omega_{3q} \Delta NLD_{t-q} + \varepsilon_{3t} \quad (2)$$

$$IND_t = \varphi_3 + \delta_3 t + \lambda_3 e_{t-1} + \gamma_{31} \Delta IDN_{t-1} + \dots + \gamma_{3p} \Delta IDN_{t-p} + \omega_{31} \Delta IDN_{t-1} + \dots + \omega_{4q} \Delta NLD_{t-q} + \varepsilon_{4t} \quad (3)$$

$$NLD_t = \varphi_4 + \delta_4 t + \lambda_4 e_{t-1} + \gamma_{41} \Delta IDN_{t-1} + \dots + \gamma_{4p} \Delta NLD_{t-p} + \omega_{41} \Delta IDN_{t-1} + \dots + \omega_{1q} \Delta NLD_{t-q} + \varepsilon_{1t} \quad (4)$$

Where:

$\varphi, \delta, \lambda, \gamma, \omega$	= Estimated parameters
IDN	= Indonesia
CHN	= China
IND	= India
NLD	= Netherland

3. Results and Discussion

3.1. Result

3.1.1. Export Patterns of Ginger in Indonesia, China, India, and the Netherlands

Export forecasting begins with knowing past data on ginger exports in Indonesia, China, India, and the Netherlands during January 2013 to December 2017. The data plots exports of Indonesian, Chinese, Indian and Netherland Ginger to the world are patterned with random component data.

3.1.2. Ginger Export Relations of 4 Countries (Indonesia, China, India, and Netherland)

3.1.2.1. Stationary Test

Stationary data is needed to influence the test results of VECM estimates. The probability of ADF t-statistical Indonesian variables is greater than the 5% *Test Critical Value*, namely $-3.917571 > -2.911730$, has a probability value of < 0.05 which is 0.0035. Variable China has also met the requirements of stationariness, where it is known that the probability of ADF t-statistical Chinese variables is greater than the value of the *Test Critical Value* 5%, which is $-3.067798 > -2.911730$, has a probability value of < 0.05 which is 0.0346. The ADF t-statistical probability of Indian variables is greater than the *Test Critical Value* of 5% is $-2.923028 > -2.911730$, has a probability value of < 0.05 which is 0.0487. Variable Netherland has met the requirements of stationariness, where it is known that the probability of ADF t-statistical Indian variables is greater than the value of the *Test Critical Value* 5% which is $-4.541426 > -2.913549$, has a probability value of < 0.05 which is 0.0005. All variables have met the requirements of the stationariness of the ADF test data where, the t statistical ADF value is greater than the 5% *Test Critical Value* at the level.

3.1.2.2. Determination of the Length of the Estimation Log (VECM)

The results of the VECM estimation lag can be seen in Table 1.

Table 1. Optimal lag test results for ginger exports in Indonesia, China, India, and Netherlands for the period of January 2013 – December 2017

Was	LogL	LR	FPE	AIC	SIC	HQC
0	-2074.424	On	7.83e+27	75.72504	75.72504	75.63551
1	-2003.033	129.8010	1.05e+27*	73.56485	74.29479*	73.84712*
2	-1994.972	13.48506	1.41e+27	73.85351	75.16740	74.36161
3	-1971.951	35.15815*	1.12e+27	73.59823	75.49608	74.33214
4	-1954.459	24.17174	1.11e+27	73.54395*	76.02575	74.50368
5	-1942.929	14.25506	1.42e+27	73.70650	76.77225	74.89205

Source: Eviews (processed)

The determination of lag length is done by looking at the values on *Likelihood Ratio* (LR), *Final Prediction Error* (FPE), *Akaike Information Criterion* (AIC), *Schwarz Information Criterion* (SC), and *Hannan-Quin Criterion* (HQ). The optimal lag length lies in lag 1 based on *eviews*.

3.1.2.3. Cointegration Test

Test 5%, there are three *rank* variables related to cointegration. This can be proven from the *trace statistics* values of 53.26674, 31.25825, and 3.990304 greater than the *Critical Value* of 0.05, namely 47.85613, 29.79707, and 3.841466.

3.1.2.4. Granger Causality Test

The results of using the granger causality test are described in Table 2.

Table 2. Granger causality test results on Indonesian, Chinese, Indian, and Netherland ginger exports for the period of January 2013 – December 2017

Null Hypothesis	Obs	F-Statistic	Prob.
China does not Granger Cause Indonesia	59	0.83760	0.3640
Indonesia does not Granger Cause China		2.58925	0.1132
India does not Granger Cause Indonesia	59	0.16332	0.6877
Indonesia does not Granger Cause India		1.64484	0.2049
Netherland does not Granger Cause Indonesia	59	0.45671	0.0478
Indonesia does not Granger Cause Netherland		2.17622	0.1458
India does not Granger Cause China	59	1.28760	0.2613
China does not Granger Cause India		0.57403	0.4518
Netherland does not Granger Cause China	59	0.92481	0.3403
China does not Granger Cause Netherland		0.00094	0.9757
Netherland does not Granger Cause India	59	8.60246	0.0049
India does not Granger Cause Netherland		1.26245	0.2660

Source: EViews (processed)

The Netherland variable that statistically significantly affects Indonesia with a probability value of less than 0.05, namely 0.0478, thus rejecting the null hypothesis. Meanwhile, Indonesia statistically does not significantly affect the Netherlands with

a probability value greater than 0.05, namely 0.1458, thus accepting the null hypothesis. The export of Netherland ginger affects the export of Indonesian ginger, meaning that when the Indonesian government wants to export ginger, the government will look at the export value of Netherland Ginger because the export value of Netherland ginger will determine the amount of Indonesian ginger exports in accordance with the State Budget. Thus, it can be concluded that there is a one-way causality between the variables of Netherland ginger exports and Indonesian ginger exports. The Netherland variable is also the statistically significant one influencing India with a Probability value of less than 0.05 i.e., 0.0049 thus rejecting the null hypothesis. Meanwhile, India statistically did not significantly affect the Netherlands with a probability value greater than 0.05 which is 0.2660 thus accepting the null hypothesis.

3.1.2.5. Interpretation Vector Error Correction Model (VECM)

The results of the VECM model estimation with an optimum lag of 1 can be seen in Table 3.

Table 3. VECM estimation results on ginger exports of Indonesia, China, India, and Netherlands for the period of January 2013 – December 2017

Variable	CointEq1	
	Coefficient	t-Partial Statistics
China	0.066341	0.83738
India	0.398258	0.99821
Netherland	1.796917	2.69138

Source: EViews (processed)

Table 3 shows that the long-term VECM estimate of the Netherland variable at *lag* 1 has a positive and significant effect in Indonesia of 2.69138. This means that if there is an increase in Netherland ginger exports by 1% in the previous year, it will increase the export of Indonesian ginger in the current year by 1.796917 points. The partial t-statistical value of the Netherland variable at *lag* 1 is 2.69138 or greater than 1.671 which means that the Netherland variable has a positive and significant effect on the export Indonesian ginger in the long term.

By the empirical facts that exist in the long run Netherland ginger exports are significantly positive for Indonesian ginger exports meaning that if the export of Netherland Ginger increases, the number of Indonesian Ginger exports will increase. It is stated that Netherland is not a producer or producer of ginger, the Netherlands country imports the largest ginger in Indonesia. So, it can be concluded that if Netherland exports increase, Indonesia's exports will also increase. The results of the short-term and long-term VECM estimates above, are valid results where, it is known from the value of the R Squared coefficient of determination of 0.17% the change in the dependent variable (Indonesia) can be explained by its independent variables (China, India, and Netherland) from a maximum of 100%.

3.1.3. Indonesian, Chinese, Indian, and Netherland Ginger Export Forecasting

3.1.3.1. Impulse Response Function (IRF) Analysis

In the IRF analysis, if there is a shock in Indonesia, India and the Netherlands, Indonesia will respond fluctuational with positive values, which means that Indonesian ginger exports will increase over the next 7 years. If there is a *shock* to

China, Indonesia's exports will respond fluctuational with negative values, which means that Indonesia's ginger exports will decline over the next 7 years.

3.1.3.2. *Variance Decomposition (FEVD)*

The forecast of Indonesian ginger exports for the next 84 periods (January 2018-December 2024) has experienced a steady increase, whose influence is dominated by Indonesia itself and three other countries, namely China, India, and the Netherlands. The Netherlands has a stronger influence on ginger exports than India and China, both in the short and long term. *Variance Decomposition* of Chinese Ginger exports has increased steadily, whose influence is dominated by China itself and three other countries, namely Indonesia, India, and the Netherlands. The Netherlands has a stronger influence on the export of Chinese ginger than India and Indonesia, both in the short and long term. *Variance Decomposition* of Indian Ginger exports for the next 84 periods (January 2018-December 2024) has increased, whose influence is dominated by India itself and three other countries, namely Indonesia, China, and the Netherlands. Indonesia has a stronger influence on ginger exports than China and the Netherlands, in both in the short and long terms. *Variance Decomposition* of Netherland Ginger exports for the next 84 periods (January 2018 – December 2024) has increased, which is influenced by Indonesia, China, India, and the Netherlands itself. Indonesia has a stronger influence on the export of Netherland ginger than China and India, both in the short and long term.

3.2. *Discussion*

3.2.1. *The Managerial Implication*

The managerial implications were obtained from the results of cointegration analysis and export forecasts using the *Impulse Response Function (IRF)* and *Variance Decomposition (FEVD)* from January 2018 to December 2024. The results showed that 4 ginger-exporting countries namely Indonesia, China, India, and the Netherland are interconnected and affect each other with the quantity declining and increasing in the long term. The countries that have a positive influence on Indonesia's ginger exports are the Netherlands and India, but the Netherlands has the most dominant influence. This is because although this country does not produce ginger, it imports the commodity from other countries, especially from Indonesia to meet local and foreign needs. When the need for the Netherlands is high, it will also affect the demand for the Netherlands ginger in Indonesia. As for India, although the country is the world's main producer of ginger, overall, India has not been able to sufficiently meet domestic needs. Consequently, India still needs imports from other countries, including Indonesia. When the needs in India are high, this will also affect the demand for Indian ginger in Indonesia. The Netherlands and India can be used as a reference for Indonesia in terms of ginger exports because the shock from both countries has a positive effect on increasing ginger exports. Various factors need to be considered to increase ginger exports and meet the needs of Indonesians, the Netherlands, and Indians. For Indonesia, the production factor is very important as the natural resources in the country can be considered an advantage, especially in the field of ginger agriculture. This is because the Indonesian plains are blessed with fertile soil. Moreover, Indonesia is the fourth most populous country in the world, with an abundant number of workers specifically for the ginger plant field of expertise [10]. Capital and infrastructure are also a very important part of boosting the economy through ginger exports. Indonesia is abundantly rich in natural

resources including ginger plants which require sufficient energy from sunlight. Besides, it can grow at altitudes between 10 and 1,500 meters from sea level [11]. The growth of large ginger rhizomes will be optimal at a height of approximately 500 meters from sea level. This plant also needs well fertile soil containing sufficient humus and is well drained. Ginger grows well in areas with rainfall between 2,500 to 4,000 millimeters per year. The higher the precipitation, the greater the weight of the rhizome produced. Additionally, ginger is sensitive to water deficiency, hence, it is usually planted in areas where rain is evenly distributed. The sale of Indonesian ginger is marked with clear market certainty but is not supported by good management. The recommended export forecasting plan with rainfall in Indonesia as an alternative consideration for decision-making is as follows [11].

The government plays an important role in the trade of Indonesian ginger in the international market. In Indonesia, the parties that play a role in the ginger commodity trade are the Ministry of Trade, Ministry of Industry, and the Ministry of Agriculture [8]. The Ministry of Agriculture's role in Indonesia is to assist farmers in increasing the yield of ginger cultivation. The availability for export is not in the interest of this department but is dependent on the market. Ginger cultivation is not forced on farmers, but only for those who are interested or those who get capital assistance. The Ministry of Agriculture also has a role as a policy maker, especially in the process of quality standardization. This role is useful for carrying out appropriate cultivation techniques to make the results meet predetermined standards. The existing quality standardization is based on import standards applied by the destination country of Indonesian ginger exports [12]. The ginger trade over the borders of the country is subject to general import duties and value-added taxes by the government. General import duty is the imposition of tariffs on generally accepted imported goods stipulated based on the regulation of the Minister of Finance of the Republic of Indonesia No. 110/PMK.010/2006 dated November 15, 2006, concerning tariffs. The amount of this general import duty is 5%, while the amount of the tariff for the export is set in the value-added tax (VAT). The VAT rate stipulated based on Law No. 8 of 1983 which was amended into Law No.18 of 2000 is 10%. This policy will help the Ministry of Trade to protect domestic industries by imposing larger export tariffs on Indonesian ginger exporters while Indonesian imports are not too large. The formation of partnerships will help farmers in producing ginger stably and in the form of capital. These partnerships are expected to benefit farmers as well as industrial entrepreneurs. The farmers will get assistance in terms of capital, while entrepreneurs are guaranteed sufficient supplies for industry and exports according to their desired quality.

4. Conclusion

Based on the results, it can be concluded results indicate that three co-integrations occur in ginger exports between Indonesia, China, India, and the Netherlands, in other words, the four countries are involved in the long term. However, those who influenced each other's increase and decrease in exports were Indonesia, the Netherlands, and India. The sales forecast results obtained using the IRF for 2018-2024, show that Indonesia's response is negative due to *shocks* from China thereby causing a decrease in exports, while *shocks* from India and the Netherlands cause a positive response or an increase in exports. Meanwhile, the forecast results obtained

using FEVD show that Indonesia's exports tend to decline, with the most significant influence being caused by Indonesia and the Netherlands. China had a volatile trend but stable exports whose influence is dominated by China itself and the Netherlands. India is heading for a decline in exports with the major influence coming from India itself and Indonesia. As for the Netherlands, it is aiming for a decrease in exports, the influence is dominated by the Netherlands and Indonesia. Regarding the managerial implications obtained, the countries that are most influential in increasing Indonesia's exports are the Netherlands and India, hence, several factors such as nature, human resources, capital, and infrastructure need to be considered to increase ginger exports.

References

1. BPS. Statistik Nasional biofarmaka Indonesia 2018 [Internet]. Badan Pus. Stat. Badan Pusat Statistik; 2019. Available from: <https://www.bps.go.id/publication/2019/10/07/65ba24004819d2bbb96bdf63/statistik-tanaman-biofarmaka-indonesia-2018.html>
2. Akbar RA, Rusgiyono A, Tarno. Analisis integrasi pasar bawaang merah menggunakan metode vektor error correction model (VECM) (Studi kasus: harga bawang merah di provinsi Jawa Tengah). J Gaussian. Department of Statistics, Faculty of Science and Mathematics, Universitas Diponegoro; 2016;5:811–20.
3. Direktorat Jendral Hortikultura. Laporan tahunan Direktorat Jendral Hortikultura tahun 2018 [Internet]. Jakarta; 2019. Available from: <https://hortikultura.pertanian.go.id/wp-content/uploads/2019/07/Laptah-Horti-2018.pdf>
4. FAOSTAT. Crops and livestock products-production of ginger, raw [Internet]. FAO. 2022 [cited 2023 Jan 12]. Available from: <https://www.fao.org/faostat/en/#data/QCL/visualize>
5. Embassy of the Republic of Indonesia in Brussels. Indonesia's potential herbal products gain in the European market [Internet]. 2021. Available from: <https://kemlu.go.id/download/L1NoYXJlZCUyMERvY3VtZW50cy9icnVzc2VsL3Jlc2VhcmNoJTlwc2VyaWVzL1Jlc2VhcmNoJTlWU2VyaWVzJTlWSW5kb25lc2lhJTlWUG90ZW50aWFsJTlWSGVyYmFsJTlWUHJvZHVjdHMucGRm>
6. CBI. The European market potential for dried ginger [Internet]. Minist. Foreign Aff. 2022 [cited 2023 Jan 12]. Available from: <https://www.cbi.eu/market-information/spices-herbs/dried-ginger/market-potential>
7. FAOSTAT. Crops and livestock products-production/yield quantities of ginger, raw in Indonesia [Internet]. FAO. 2022 [cited 2023 Jan 12]. Available from: <https://www.fao.org/faostat/en/#data/QCL/visualize>
8. Wiedhayat D. Ginger: superior, hot export commodity for your healt - what's inside. Jakarta; 2016.
9. Purwito A, Indriani. Ekspor, impor, sistem harmonisasi, nilai pabean dan pajak dalam kepabeanan. Jakarta: Mitra Wacana Media; 2015.
10. Koswara S. Jahe dan hasil olahannya. Jakarta: Pustaka Sinar Harapan; 2008.
11. Latifah, Djauhari E, Januwati M, Rizal M, Wardana HD, Hendani N, et al. Standar operasional prosedur (SOP) budidaya jahe (Zingiber Officinale). Jakarta: Direktorat Budidaya Tanaman Sayuran dan Biofarmaka; 2008.
12. BSN. Standar Nasional Indonesia Jahe Segar SNI-01-3179-1992. Jakarta; 1992.